CIBSE Home Counties North East Region
Tuesday, 15 July 2014

DIALux evo lighting design software
- BS EN 12464-1
- Energy optimization and LENI
- DIALux and BIM
- Designing with LED’s

Speaker:
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Teamleader Sales, DIAL GmbH

BS 12464

- The BS12464 ask for further data than just average illuminance level or glare
- There is a number of changes and new measures in the 2011 release
- Those most important for lighting calculation / design:
  - 4.2 Luminance Distribution Measures
  - 4.2 Illuminance grid (1)
  - 4.3 Illuminance values
  - 4.4 Illuminance grid (2)
  - 4.6 Lighting in the interior space
  - 4.9 Lighting of workstations with DSE
  - 4.11 Energy Efficiency Requirements
  - 4.13 Variability of light
4.2 Luminance Distribution Measures

- The luminance distribution in the visual field controls the adaptation level of the eyes which affects task visibility.

\[
\begin{align*}
\text{Ceiling} & \quad \rho = 0.7 - 0.9 \\
E_m &= 30 \text{ lux}, \ U_o \geq 0.1
\end{align*}
\]

\[
\begin{align*}
\text{Walls} & \quad \rho = 0.5 - 0.8 \\
E_m &= 50 \text{ lux}, \ U_o \geq 0.1
\end{align*}
\]

\[
\begin{align*}
\text{Floor} & \quad \rho = 0.2 - 0.4
\end{align*}
\]

4.2 Illuminance grid (1)

- A border of 0.5 m from the walls is excluded from the calculation area except when a task area is in or extends into this border area.
4.3 Illuminance

<table>
<thead>
<tr>
<th>Task [lx]</th>
<th>Immediate Surround [lx]</th>
<th>Background [lx] 1/3 $E_{\text{task}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;750</td>
<td>500</td>
<td>167</td>
</tr>
<tr>
<td>500</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>300</td>
<td>200</td>
<td>67</td>
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<tr>
<td>200</td>
<td>150</td>
<td>50</td>
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<tr>
<td>150</td>
<td>$E_{\text{task}}$</td>
<td>50</td>
</tr>
<tr>
<td>100</td>
<td>$E_{\text{task}}$</td>
<td>33</td>
</tr>
<tr>
<td>&lt;50</td>
<td>$E_{\text{task}}$</td>
<td>1/3 $E_{\text{task}}$</td>
</tr>
</tbody>
</table>

$U_{0} > 0.4$ $U_{0} > 0.1$

4.4 Illuminance grid

- An appropriate grid size shall be applied to walls and ceiling and a border of 0.5 m may be applied also.
A design example in a small assembly hall

Table 5.18 — Industrial activities and crafts — Metal working and processing

<table>
<thead>
<tr>
<th>Ref. no.</th>
<th>Type of area, task or activity</th>
<th>( \mathcal{E}_m ) [lx]</th>
<th>( \mathcal{L}_{\text{CAL}} )</th>
<th>( \mathcal{L}_I )</th>
<th>( \mathcal{L}_B )</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.18.10</td>
<td>Tool making, cutting equipment manufacture</td>
<td>750</td>
<td>19</td>
<td>0.70</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>5.18.11</td>
<td>Assembly:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- rough</td>
<td>200</td>
<td>25</td>
<td>0.60</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- medium</td>
<td>300</td>
<td>25</td>
<td>0.60</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- fine</td>
<td>500</td>
<td>22</td>
<td>0.60</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- precision</td>
<td>750</td>
<td>19</td>
<td>0.70</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>5.18.12</td>
<td>Galvanising</td>
<td>300</td>
<td>25</td>
<td>0.60</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

- Ceiling
  \( \rho = 0.7 - 0.9 \)  
  \( \mathcal{E}_m = 30 \) lux, \( U_o \geq 0.1 \)

- Walls
  \( \rho = 0.5 - 0.8 \)  
  \( \mathcal{E}_m = 50 \) lux, \( U_o \geq 0.1 \)

- Floor
  \( \rho = 0.2 - 0.4 \)

Task (lx) | Immediate Surround (lx) | Background (lx) | \( \frac{1}{3} \mathcal{E}_{\text{task}} \) |
<table>
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<tr>
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<tr>
<td>200</td>
<td>150</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>( \mathcal{E}_{\text{task}} )</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>( \mathcal{E}_{\text{task}} )</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>
| <50       | \( \mathcal{E}_{\text{task}} \) | \( \frac{1}{3} \mathcal{E}_{\text{task}} \) | \( U_o \geq 0.4 \)  

Standards Control Centre
Main room surfaces

Task-, Surrounding-, Background Area
4.6 Lighting in the interior space

Mean cylindrical illuminance ($E_c$) requirements in the activity space
$E_c = 50 \, \text{lx} \quad Uo \quad 0.10$ (in offices, meeting teaching areas 150 lx) at 1.2m for sitting & 1.6m for standing people above the floor

Modelling
$E_c/E_h$ of 0.30 – 0.60 at 1.2m above floor is an indicator of good modelling

Directional lighting of visual task
Lighting from specific direction can reveal more details in the visual task, increase the task visibility and form, and create helpful shadows.

Lighting in the interior space ($E_c$, Modelling)
Lighting Energy Numeric Indicator, LENI

- LENI is defined in the European Standard EN15193
- The standard is covering the „Energy Performance of Buildings“
- It specifies the calculation of the amount of energy used for indoor lighting
- Can be used for existing buildings and for the design of new or renovated buildings.

It’s not that simple

The lighting design process

- **Project analysis**
  - Area 1
  - Area 2
  - Area 3
  - Area 4

- **Utilization**
- **Architecture**
- **User demands**

- **Development of a lighting strategy**

- **Arrangement of luminaires**

- **Dimensioning:** light sources, power, flux, # of luminaires
- Calculation and optimization of the LENI values

- **Finishing the design**
What LENI takes into account

Energetic optimization
BIM Building Information Modelling

BIM:
Definition: What do we mean by a door?
Function: What are the properties of a door?
Performance: What must the door be able to do?

CAD:
Only lines

• One set of data for all programs
• Work has to be done only once
• Changes happen everywhere for everybody
• A way of working together
• Open digital description

BIM for lighting designer

• Lighting design is one step in the building design process
• The lighting designer needs data from the building structure
• The lighting designer works out the lighting layout and passes this information to the architect / electrical engineer
• The lighting designer has to provide data about the products used
• Do we all have to use Revit now? - Is BIM only Revit?
The BIM process of lighting design

- Any program can be used. All programs share the same data.
- The BIM data is the IFC data model

Interoperability in DIALux

- DIALux offers a simple DWG/DXF interface, this is not BIM
- DIALux offers a proprietary interface called STF supported by more than 25 CAD software applications including Autodesk MEP and Nemetschek Vectorworks. This is a simplified logical model for lighting purpose only. “Mini-BIM”
- DIALux offers a gbXML interface. gbXML is for transferring building properties to analysis software. As BIM data mostly is to much information for the analysis tool, gbXML simplifies the transfer.
First example using DDS-CAD

1. Define the building:
   Define the outer reality, outlining the building with the "Surface Zone" function.

2. Create the rooms:
   The result.

3. Export the room information to STF:
   Export to STF and open in DIALux.

4. DDS-CAD and DIALux - the STF Interface:
   Do the lighting design in DIALux and export to STF.

5. Continue with your light calculations in DDS-CAD and transfer them to DIALux.

Second example using AX3000

6. AX3000 DIALUX INTERFACE:
   The rays from walls, windows, and doors will be directly sent to DIALUX, and then the calculation data will be sent back to the CAD system.
Using STF / gbXML in DIALux

• Example created by Autodesk AutoCAD MEP

DIALux and BIM

• Already now BIM data can be transferred using STF or gbXML
• STF is able to import and export data
• gbXML is able to be imported (to DX) and exported as DWG
• The lighting designer does not need a BIM CAD software (Revit, Vectorworks, Microstation…)
• The lighting industry provides DIALux Plugins. The product data is used to be exported to the BIM file / software
Lighting design and LED’s

- LED luminaires are nothing special for a state of the art software
- LED’s as lamps or luminaires are offering additional information / benefits for the design:
  - High efficiency
  - Long maintenance cycles
  - Wide variety of available light colours
  - Good colour rendering
  - Controllability
  - Small size
  - Modularity
- All this data has to be transferred to and to be used by a design software

Photometric data

- Photometric data of luminaires is necessary to do a lighting calculation
- Is there a problem with SSL products and photometric data?
Relative vs. Absolute photometry

- We first test the lamp and then the luminaire
- Data for the luminaire independent from the lamp used during the testing
- Data normalized to 1000 lumens
- Light output ratio (LOR)
- Data can be adapted to changes
- The designer can use a specific lamp flux

- The problem with LED luminaires:
  There is no lamp!

Absolute photometry

- The IESNA has published a document about “Electrical and Photometric Measurements of Solid State lighting products” the IES LM-79-08
- LM 79 says that the presentation of the normalized luminous intensity distribution cannot be used for SSL products
- Instead of the light output ratio we have to display the luminous efficacy as: \( \eta_V = \Phi_{\text{Test}} / P_{\text{Test}} \) [lm/W]
- IES files are not 1:1 compatible to EULUMDAT / TM14
  - No luminaire geometry
  - Completely different coordinate system
- A lot of confusion with data from far east and from the US
Photometric data

- What is missing?

- Spectra, max. flux for each channel

Source: ERCO, Philips

Photometric data

- What is missing?

- Controllable beam angle, different luminous intensity distributions

Source: Schreder, Philips
Photometric data

- Existing standard data formats are not able to transfer all the specific product information to the design software
- The lighting designer is not able to use all the product features in his design
- The end user cannot “see” the advantages of the LED products

Solution:
LED luminaires with complex photometric data should be presented in electronic catalogues that support the specific features of SSL lighting products.

Electronic catalogues / PlugIns

- Offering technical data is good for those who know what it means
- Showing an example is just better
- Inspire the user and show him what he could get

Source: Philips
Thank you very much for your attention!

Download DIALux from: [www.dialux.com](http://www.dialux.com)
Find luminaires on: [www.lumsearch.com](http://www.lumsearch.com)
Find video tutorials at: [http://www.youtube.com/user/TheDIALux](http://www.youtube.com/user/TheDIALux)

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